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A PRELIMINARY INVESTIGATION OF
THE COMMON-CORE PROGRAM AND THE LEARNING OF BASIC ELECTRICAL THEORY
at the
CLASS A ELECTRICIAN'S MATES SCHOOL, SAN DIEGO, CALIFORNIA

December 1953

The research reported here was sponsored by the Office of Naval Research, Personnel and Training Branch, under Contract No. N8 onr 70000, Task I, and was performed at the request of the Service School Command, San Diego Naval Training Center.

Management and Marketing Research Corporation

Los Angeles

We wish to express our thanks to the
Commanding Officer, Service School Command,
for permission to perform this study and to
the Commanding Officer, Class A Electrician's
Mates School, San Liego, and the Petty Officers
on the Instructional Staff for their interest
and participation in the study.

THE COMMON-CORE PROGRAM AND THE LEARNING OF BASIC ELECTRICAL THEORY
AT THE ELECTRICIAN'S MATES SCHOOL, SAN DIEGO

Summary

Theoretical understanding of electricity by trainees at the Electrician's Mates (EM) School, San Diego, was measured by the number of questions on electrical theory they answered correctly on the written Final Achievement Examination.

The scores of two groups of trainees were compared:

1. 206 men who were trained under the Common-Core program.
2. 200 men who graduated before the Common-Core program was begun.

The average number of questions on electrical theory answered correctly was approximately the same for both groups.

To the extent that ability to answer the questions chosen from the final exam can be considered indicative of theoretical understanding, it can be tentatively concluded that there was no reduction in theoretical learning under the Common-Core program at the EM School, San Diego.

Description of the Study

This was an "after the fact" study.

The Common-Core program in basic electricity, taught with the Craftsman Method, was introduced at the EM School, San Diego N. T. C., midway through fiscal year 1953, beginning with Class 14-53. The question soon arose as to whether the six weeks of Common-Core training resulted in any change in the learning of electrical theory as compared with the learning of theory in pre-Common-Core classes. The latter classes received considerably more lecture material and were exposed to a greater number of theoretical problems.

100 questions were common to the written Final Achievement Examinations administered to trainees in classes graduating both before and after the Common-Core program was begun. 68 of these questions were judged by a jury of project

members to have a primarily "theoretical" content. That is, practical experience or knowledge was not considered to be required for a trainee to answer a question correctly.

Data were available from Classes 2-53 through 6-53 (the "Before Group") on the number of men failing each of these 68 questions. The average score made by 200 pre-Common-Core trainees was computed from these data. The average score made by 206 trainees in Common-Core Classes 17-53 through 23-53, (the "After Group") was obtained from their individual Final Achievement Exam answer sheets.

The comparison of the average scores made on the 68 theoretical questions by the trainees in the Before and After Groups was the basis for the preliminary observations made here on the effect of the Common-Core program on theoretical learning at the EM School. Before comparing the average scores, however, it was necessary to determine if the trainees in the two groups were similar in aptitudes, interests, and experience. Data were gathered and examined from the following sources:

1. The trainees' Basic Battery scores (General Classification, Arithmetical Reasoning, and Mechanical Aptitude tests).
2. Biographical information recorded by the trainees concerning their age, their civilian education and occupation, their Navy experience, their hobbies, and their service school preference.

The average aptitude scores for the trainees in the Before and After Groups were not significantly different. The tabulated biographical data indicated that the two groups of trainees were similar in age, education, interests, and experience.

These data are summarized in Tables I, II, and III. It is considered that the similarities between the two groups of trainees justify the comparison of their scores on the 68 questions selected from the Final Achievement Exam.

TABLE I

Average Aptitude Scores on the General Classification (GCT),
Arithmetical Reasoning (ARI), and Mechanical Aptitude (MAT)
Tests for Trainees in the Before and After Groups

Before Group (N = 200)	GCT	ARI	MAT	After Group (N = 206)	GCT	ARI	MAT
Class 2-53	50.17	55.60	52.26	Class 17-53	59.31	54.00	56.30
3-53	50.69	54.96	55.06	18-53	58.32	51.03	53.90
4-53	54.27	55.20	53.26	19-53	56.65	55.00	51.00
5-53	57.23	54.32	53.76	20-53	54.94	54.10	52.42
6-53	56.02	55.14	53.56	21-53	57.10	55.19	53.90
				22-53	55.00	52.00	53.64
				23-53	59.14	55.57	56.21
TOTALS	57.20	55.00	53.66	TOTALS	56.36	54.02	53.79

TABLE II

Proportions of Trainees in the Before (N=200) and After (N=206) Groups
with the Backgrounds, Experience, Interests, or Preferences
Indicated by the Variables Tabulated Below

School Subjects Taken	Before Group	After Group	Civilian Occupation	Before Group	After Group	Hobbies	Before Group	After Group
Algebra	.76	.79	Student	.24	.19	Autos	.36	.32
Geometry	.42	.45	Factory	.00	.11	Electricity	.16	.14
Trig	.08	.05	Farmer	.09	.05	Radio	.06	.04
Physics	.20	.23	Trade	.27	.30	Reading	.20	.24
Chemistry	.27	.29	Labor	.13	.14	Making Things	.04	.02
			Office	.01	.04			
			Sales	.12	.16			
			Misc.	.06	.01			

Request in School?	Before Group	After Group	Prefer Other School?	Before Group	After Group	Prior Navy Experience	Before Group	After Group
Yes	.90*	.97	Yes	.12	.07	Recruit	.50	.50
No	.10	.03	No	.70	.06	Fleetman	.50	.50
* This includes trainees who changed their answers.			No other preference	.18	.07			

TABLE III

Average Ages of Trainees in the Before and After Groups, Their Average No. of Years in School, and Their Average No. of Years in the Navy

	Before Group (N = 200)	After Group (N = 206)
Age in years	19.81	19.80
Years in School	11.42	11.39
Years in the Navy	.82	.82

In addition, information was gathered concerning the curriculum changes (see Table V), instructor changes, and administrative changes at the EM School during the time the two groups were in training. Thirty-five instructors taught classes in both groups, and 29 instructors taught classes in just one group. There was also a change of command at the EM School between the training periods of the two groups. The effect of these instructor and administrative changes on the learning of the trainees could not be calculated.

Results of the Study

The average score made on the 60 theoretical questions by trainees in the Before Group was 44.72 compared to an average of 45.16 for the After Group. These averages plus the individual class averages are given in Table IV. They indicate that the performance of the two groups on theory questions was essentially equal.

TABLE IV

Average Scores on 60 "Theoretical" Questions from the Final
Achievement Exam made by Classes Trained Before
and After the Common-Core Program was Begun

Before Group (N = 200)	Average Score	After Group (N = 206)	Average Score
Class 2-53	42.77	Class 17-53	45.70
3-53	47.39	18-53	46.36
4-53	44.57	19-53	42.40
5-53	44.24	20-53	47.71
6-53	44.11	21-53	45.12
		22-53	45.40
		23-53	42.50
TOTAL	44.72	TOTAL	45.16*

* There is no significant difference between these two TOTAL scores. However, 45 men had been dropped from the After Group before graduation. This could have resulted in a rise in the average score for this group since the poorer men's scores were not figured in. (It was estimated by school personnel that the drop-out rate from the Before Group had been much lower.) To see whether or not the dropping of a higher percentage of men could have biased the results in favor of the After Group, all of the men who had been dropped were added into the TOTAL by giving them scores equal to the average of the lowest achieved by those who passed the course. This resulted in an average TOTAL score of 43.69 for the After Group. This, also, was not significantly different from the TOTAL score for the Before Group.

The 60 questions selected from the Final Achievement Exam fell roughly into five categories: (1) current flow, magnetism, and induction; (2) direct current circuits; (3) alternating current circuits; (4) direct current machinery; and (5) alternating current machinery. An examination of allocations of instructional time for both the pre-Common-Core and Common-Core curricula revealed that there was comparatively little difference in the number of instructional periods (one period = 55 minutes) devoted to each of the above phases of basic electricity. But the number of periods does not tell the whole story. It was learned from conversations with instructors at the EM School that up to 35 per cent more time may be spent under Common-Core on "practical" work, as distinct from pre-Common-Core instruc-

tional practices. Thus it would appear that there was considerably more emphasis put on practical application in the average class period under Common-Core, with less attention being devoted to theoretical discussion.

The average scores made by the trainees in the Before and After Groups on the questions in the different categories, plus the number of periods devoted under the two different training methods to instructing the trainees in the material covered by each category, are shown in Table V.

TABLE V

Average Scores Made by Trainees in the Before and After Groups On
Questions of Electrical Theory, Categorized by Kind, Plus
the Number of Periods Spent Instructing the Categorized Material

Question Category	Before Group (N=200)		After Group (N=206)	
	No. Periods	Avg. Score	No. Periods	Avg. Score
Current Flow, Magnetism and Induction	35	6.10	45	6.40
Direct Current Circuits	70	5.00	60	5.06
Alternating Current Circuits	70	6.50	70	6.40
Direct Current Machinery	35	9.07	35	10.46
Alternating Current Machinery	35	14.46	35	13.94
TOTALS	245	44.73	245	45.14

Conclusions of the Study

Trainees who were given the Common-Core of basic electricity in a six weeks' program of "discussion, demonstration, and experiment" got, on the average, the same number of questions right on a written test of their understanding of electrical theory as did trainees who spent up to 35 per cent more of their school time listening to lectures and classroom demonstrations.

Within the limits of the "after the fact" data and the experimental design of this study, it can be stated that in the EM School, taking instruction as it came,

there was no difference in ability to answer theoretical questions between pre-Common-Core and Common-Core trainees.

Suggestions for Future Research

This study questioned only one of the effects of the Common-Core program and is tentative in its indications. To understand the full effects of providing, with the Craftsman Method, a Common-Core of knowledge to trainees in several different Navy rates, it is suggested that a well-controlled program of testing (both written tests and performance tests) be set up in an applicable Class A School before a planned shift to Common-Core is made. The continuation of this same testing program under Common-Core would result in scores that would give fairly specific indications of the levels of learning, both practical and theoretical, achieved under the different training methods.

A series of such "before the fact" experiments might be expected to indicate:

1. The relative abilities of pre-Common-Core and Common-Core trainees to perform the practical factors of the rates for which they are being trained.
2. The relative abilities of the two groups of trainees to understand the theories that are used to explain the workings of electrical and mechanical systems.

In addition to a series of within-school experiments, a follow-up study in the Fleet of men trained under Common-Core would indicate the extent to which Common-Core training prepares men to handle their shipboard jobs.